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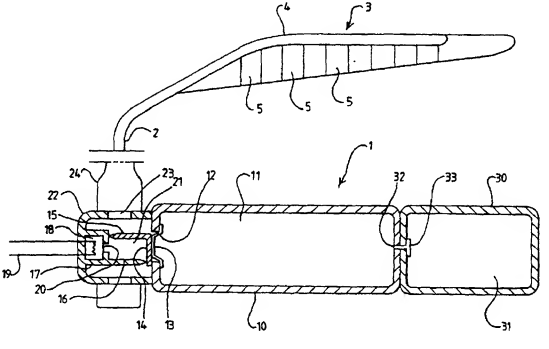
(54) **A gas generator arrangement for an airbag and a method of inflating an airbag**

(57) A gas generator is provided for inflating an air-bag in a motor vehicle. The gas generator includes a first source(10) of gas adapted to inflate the air-bag(3) relatively rapidly. The arrangement includes a second source(31) of gas adapted subsequently to provide a flow of gas through a relatively small diameter bore(32) over a relatively long period of time to maintain the air-bag(3) in a substantially inflated state.



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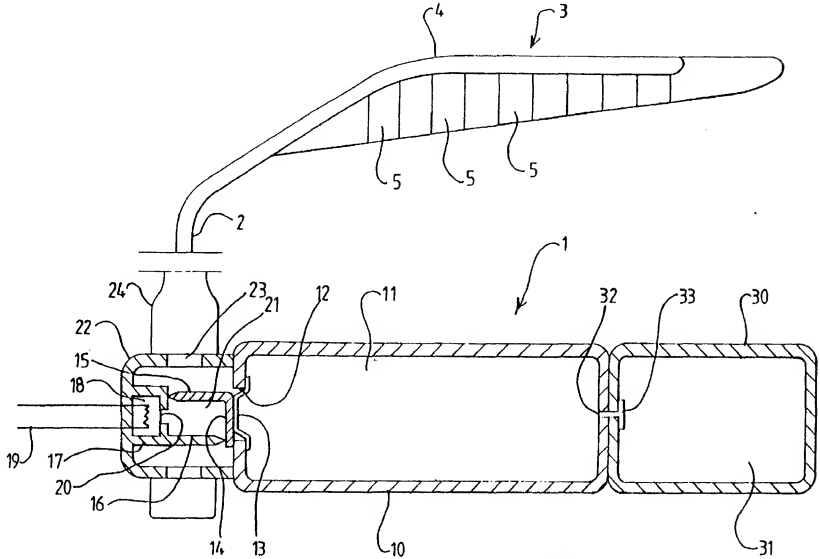
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PATENTS ACT 1977
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DESCRIPTION OF INVENTION

"IMPROVEMENTS IN OR RELATING TO A GAS GENERATOR ARRANGEMENT FOR AN AIR-BAG AND A METHOD OF INFLATING AN AIR-BAG"

THE PRESENT INVENTION relates to a gas generator arrangement for an air-bag for use in a motor vehicle and also relates to a method of inflating an air-bag for use in a motor vehicle.

It has been proposed to provide air-bags in motor vehicles adapted to be inflated should an accident occur, the air-bags performing the function of protecting an occupant of the vehicle. Air-bags have been proposed which when inflated, are located in front of the occupant of the vehicle. Such air-bags are typically inflated over a very brief period of time, for example, 15 msec, and such bags typically deflate within a period of less than 100 msec following an accident.

Other air-bags have been proposed, which, when inflated, are located between an occupant of the vehicle and adjacent side of the vehicle. Typically such air-bags may initially be located in a recess provided in the roof of the vehicle immediately above the vehicle door, the air-bag, when inflated, being located between the occupant of the vehicle and at least the upper part of the door. Such air-bags have been found to be of value, especially when providing protection against injuries that might arise during a side impact, or during a roll-over.

Should a motor vehicle be involved in an accident that involves a roll-over, the accident may have a substantial duration. Thus, a roll-over accident may last for several seconds.

If an air-bag is only inflated for a very brief period of time, the air-bag will not provide adequate protection for an occupant of the vehicle during a typical roll-over accident.

The material from which air-bags are conventionally made is actually permeable to the gas that is used to inflate the air-bags. Consequently, because of the permeability, when gas has been supplied to the air-bag to inflate it, the air-bag cannot remain inflated for a long period of time. It is possible to seek to increase the time that a bag may stay inflated by coating the material that is used to make the air-bag. The provision of such a coating is, however, expensive. Also, it has been found to be difficult to provide a coating on a bag which is configured to be located between the occupant of the vehicle and the side of the vehicle. Whilst it might be thought possible to increase the time that an air-bag is inflated by using a large gas generator, this is not the case. A larger gas generator will supply more gas to the bag and may cause the bag to burst due to excess pressure within the bag.

The present invention seeks to provide an improved gas generator arrangement for use with an air-bag provided in a motor vehicle, the arrangement being intended to operate in such a way that the arrangement will inflate the air-bag and maintain the air-bag in an inflated condition for a relatively long period of time. The present

invention also seeks to provide an improved method of inflating an air-bag.

According to this invention there is provided a gas generator arrangement for inflating an air-bag in a motor vehicle, the gas generator arrangement comprising a first source of gas adapted to inflate the air-bag relatively rapidly, and a second source of gas adapted subsequently to provide a flow of gas to the air-bag over a relatively long period of time to maintain the air-bag in a substantially inflated state.

Preferably the first source of gas comprises a bottle of compressed gas adapted to communicate with the interior of the air-bag through a flow passage of relatively large diameter.

Conveniently the second source of gas comprises a bottle containing compressed gas, the bottle communicating with the interior of the air-bag through a flow passage.

Advantageously the first source comprises a bottle containing compressed gas, the bottle having an outlet port initially sealed by a membrane, means being provided on the exterior of the bottle in a supporting position to support the membrane and means being provided to remove the support from the supporting position in response to a signal from a sensor.

Preferably the means adapted to remove the support comprise a pyrotechnic charge adapted to generate gas and supply the gas to a chamber defined at least partly by the support or means associated with the support.

Conveniently the gas bottle comprising the second source is connected to the gas bottle comprising the first source through a bore which comprises said flow passage of relatively small diameter.

Advantageously the bore is initially sealed by means of a rupture or membrane adapted to rupture when a predetermined pressure differential exists across said membrane.

The gas generator may be in combination with an air-bag and preferably said air-bag comprises an air-bag mounted in position in a motor vehicle such that, when inflated, the air-bag is located between an occupant of the vehicle and a side part of the vehicle.

The invention also relates to a method of inflating an air-bag in a motor vehicle, the method comprising the steps of initially supplying a substantial volume of gas to the interior of the air-bag to inflate the air-bag relatively rapidly and supplying, over a relatively long period of time, a subsequent flow of gas to maintain the air-bag in the substantially inflated state.

Preferably the method comprises the steps of providing said substantial volume of gas from a first bottle containing compressed gas, and wherein the step of supplying the subsequent flow of gas is accomplished by supplying gas from a second gas bottle through a relatively small diameter flow passage.

Conveniently the gas from the second gas bottle is supplied to the interior of the first gas bottle.

In order that the invention may be more readily understood, and so that further features thereof maybe appreciated, the invention will now be described, by way of example, with reference to the accompanying drawing which is a schematic view of a gas generator arrangement in accordance with the invention in association with an air-bag.

Referring initially to the accompanying drawings, a gas generator arrangement 1, which will be described in greater detail hereinafter, is connected to a supply conduit 2 which is formed integrally with an air-bag 3. In the described embodiment, the air-bag 3 has an upper edge 4 which is adapted to be secured to part of the vehicle lying immediately above the door opening, the upper edge 4 forming part of the supply conduit 2. The supply conduit 2 communicates with a plurality of inflatable cells 5 which are located beneath the upper edge 4 of the air-bag 3.

It is to be appreciated that in the event that an accident should arise, and in particular in the event that a roll-over accident should arise, the gas generator arrangement 1 will supply gas to air-bag 3 causing the air-bag initially to be inflated and will subsequently supply gas to the air-bag 3 causing the air-bag 3 to remain inflated for a substantial period of time.

The air-bag will be located between the occupant of the vehicle and the upper part of the door, thus providing protection to the occupant of the vehicle.

The gas generator arrangement 1 comprises a principal source of gas in the form of a first gas bottle 10 which has a hollow interior 11, which contains compressed gas. The gas bottle 10 has an outlet port 12 of

relatively large diameter, the outlet port 12 initially being sealed by means of the membrane 13, such as a membrane formed of aluminium or other relatively soft metal, the membrane extending across the outlet port 12.

A support plate 14 is provided on the exterior of the gas bottle 10 adjacent the port 12. The support plate 14 is in a supporting position in which it supports the membrane 13. The support plate 14 is formed integrally with a cranked support arm 15, the cranked support arm 15 extending substantially parallel with a second support arm 16 that is formed integrally with a housing 17 that contains a pyrotechnic charge 18. Electric leads 19 are connected to a squib contained within the pyrotechnic charge 18. A small aperture 20 establishes communication between the interior of the housing 17 and an initially closed chamber 21 which is defined by the support arm 15 and the support arm 16.

The housing 17 and the support arms 15 and 16 are contained within a distribution manifold 22 that is formed on the exterior of the gas bottle 10. The distribution manifold 22 communicates, via distribution ports 23, with a distribution conduit 24, which in turn communicates with the supply conduit 2.

The first gas bottle 10 is associated with a second gas bottle 30 which forms a secondary gas supply. The second gas bottle 30 has a hollow interior 31 which contains compressed gas. A relatively small diameter bore 32 forms a flow passage between the interior of the second gas bottle 30 and the first gas bottle 10. In the illustrated embodiment, the bore 32 is initially sealed by means of a rupturable membrane 33 which is located on the interior of the second gas bottle 30.

It is to be appreciated that the arrangement illustrated will operate in conjunction with a sensor adapted to sense, for example, a side impact or roll-over accident. The sensor, when activated, will cause electric current to flow through the electric leads 19, thus igniting the squib contained within the pyrotechnic charge 18. The pyrotechnic charge will thus be activated and will generate gas under a high pressure.

The gas will flow into the chamber 21 and will cause the support arm 15 and the associated plate 14 to move. The plate 14 will thus no longer be in contact with the membrane 13. As a consequence of the pressure of the gas within the hollow interior 11 of the first gas bottle 10, the membrane 13 will be ruptured, since the membrane 13 is no longer supported.

Gas from the hollow interior 11 of the first gas bottle 10 will thus flow through the relatively large diameter outlet port 12 and through the relatively large diameter ports 23 formed in the outlet manifold 22 into the distribution conduit 24, through the supply conduit 2 and will thus inflate the air-bag 3. The inflation of the air-bag is accomplished relatively rapidly, within a few milliseconds, typically 15-30 msec.

As the air-bag 3 is inflated, the pressure of gas within the hollow interior 11 of the gas bottle 10 will drop. When a predetermined pressure differential exists between the interior 11 of the gas bottle 10 and the interior 31 of the second gas bottle 30, the membrane 33 will rupture. Gas will subsequently flow from the second gas bottle 30 through the relatively small diameter bore 32, through the first gas bottle 10, through the outlet port 12 and through the distribution ports 23

provided in the outlet manifold 22, through the distribution conduit 24 and the supply conduit 2 and thus to the interior of the air-bag 3. This flow of gas is at a slower rate than the flow of gas initially provided from the first gas bottle 10, and the flow of gas occurs for a relatively long period of time which may be at least two seconds, preferably at least 5 seconds and possibly 10 seconds or more. This flow of gas from the second gas bottle serves to maintain the air-bag 3 in a substantially inflated state for a relatively long period of time, for example, five or even ten seconds, or more.

It is to be appreciated that whilst one embodiment of the invention has been illustrated, various alternative embodiments of the invention can be contemplated. For example, a pyrotechnic or "hot" gas generator could be utilised instead of the first gas bottle 10, the pyrotechnic gas generator being utilised in conjunction with a bottle of compressed gas equivalent to the second gas bottle 30 which communicates with the interior of the air-bag inflated by the pyrotechnic gas generator through a relatively small diameter flow path, that flow path being opened in response to actuation of the pyrotechnic gas generator. Alternatively, the second gas bottle could be replaced by a relatively slow burning pyrotechnic gas generator adapted to generate gas over a period of, for example, five to ten seconds to keep the air-bag substantially inflated.

If, however, two bottles of compressed gas are used, it is to be appreciated that many different ways of opening the first or main gas bottle may be utilised, and whilst in the described embodiment the second gas bottle is shown connected to the first gas bottle, the second gas bottle could itself be connected directly to the outlet

manifold or to the distribution conduit, with a separate arrangement being provided to open the second gas bottle.